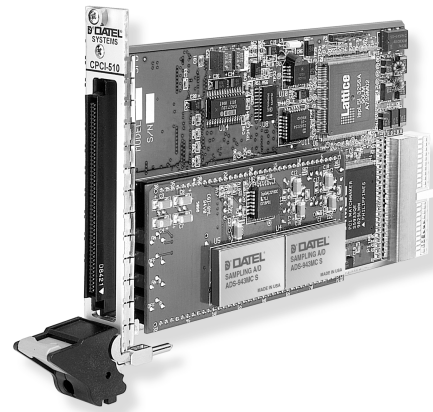


Ultra-Performance, Analog Input Boards for CompactPCI® Computer Systems

PRELIMINARY PRODUCT DATA

FEATURES

- High performance data acquisition for embedded applications
- Space saving CompactPCI 3U form factor
- Up to 10 MHz A/D sampling rates
- Choice of 12-, 14-, or 16-bit A/D resolutions
- Wideband inputs with low harmonic distortion
- 2 to 16-channel simultaneous sampling eliminates phase skew
- On-board A/D FIFO memory holds 8192 samples
- 32 megasamples or greater data streaming
- Pre/post-trigger, gap-free, ring buffering
- Ideal for DSP, FFT's, digital filtering, etc.
- Windows 95/98/NT® software; LabVIEW® drivers available



The CPCI-510 Family consists of several advanced-performance, data acquisition boards based on the 3U 32-bit CompactPCI Form Factor. CompactPCI is quickly becoming the preferred bus architecture choice for new embedded or ruggedized applications. CompactPCI combines desktop PCI performance and PC software compatibility with a rugged Eurocard packaging and passive backplane architecture.

With an emphasis on continuous, non-stop, high-speed streaming of A/D samples to host memory or disk, the system has been optimized for a wide range of signal-processing and data-recording applications. The CPCI-510 can collect huge amounts of "seamless" digitized data to host memory.

Incorporating a unique "banked" FIFO architecture, the CPCI-510 moves two A/D words in each 32-bit PCI transfer. The FIFO memory (8 Ksamples deep) serves to decouple the precise timing of the A/D converter from the block bursts of the PCI bus.

The CPCI-510's modular analog front ends utilize DATEL's low-noise, wide-bandwidth sampling A/D converters. All models exhibit excellent harmonic distortion and perform well in DSP/FFT applications. Software for Windows 95/98, NT, and LabVIEW® implements a menu-driven, no-programming", fast data recording and display system to memory or disk.

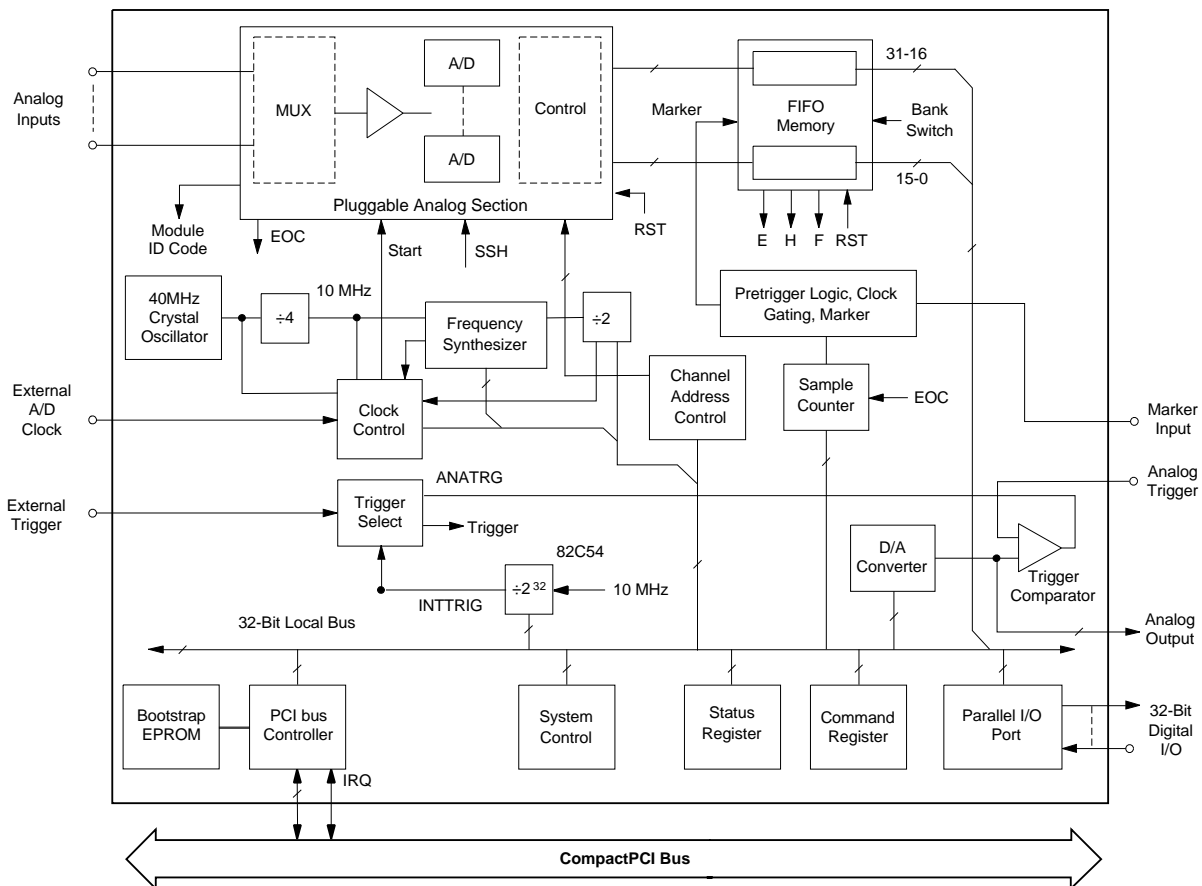


Figure 1. Simplified Block Diagram

Consider the Advantages of CompactPCI!

All the benefits of desktop PCI Computers ...

- Leverage cost and technology of industry standard components
- Operating System Compatibility
- Application Software Compatibility
- 132 Mbyte/second PCI bus transfers
- Open Architecture with 100's of suppliers

Improved for your demanding Test Applications!

- Robust Eurocard rackmount packaging
- Front loading cards with front signal access
- High performance bus connectors for improved reliability
- More expansion slots than desktop PCs
- ESD/EMI protection

Several different “pluggable” analog options offer up to 16 input channels in single-ended or differential configurations, multiple input ranges, sampling rates to 10 MHz per channel, 12-, 14-, 16-bit A/D resolutions, and various simultaneous sampling configurations (A/D per channel) up to 16 channels. A/D-per-channel boards may be operated in “software differential” mode. Two A/D’s are applied to the high and low legs of a single differential input signal. The two data values are then algebraically subtracted, either on the fly in real time or after all samples have been stored. Channel capacity in “software differential” is one-half the number of single-ended channels.

Two on-board software-programmable timebases run the A/D sample clock. A 40 MHz frequency synthesizer provides high resolution, whereas the 10 MHz 16-stage programmable divider offers very low clock jitter. If preferred, external clocks can be used for both the A/D start clock and the trigger. And several CPCI-510’s can be run in parallel via external clock for many simultaneous channels. A programmable 24-bit sample counter collects long blocks up to 16 million samples. The trigger system collects a single fixed length frame, N repeating frames separated by programmable delays, or it can run “forever”. Interrupts to the PCI bus are programmable from the FIFO half full flag, the bus master block transfer done, or the sample counter.

System features optimize gapless sampling without data loss. A pretrigger system can collect data continuously to host circular memory (ring buffer) of several megabytes or more. When an external trigger is received, the CPCI-510 will count down the number of preloaded post-trigger samples then automatically stop when all samples are collected. The trigger sample may then be found using a negative circular offset into the ring buffer, knowing the post-trigger sample count.

In addition, a digital marker input will tag data samples on the fly as often as needed. This provides later identification of external events without stopping sample collection. A 16 bit D/A converter is included to set the trip level to generate external analog triggers. Or the D/A can be used for analog output. Plus 16 digital inputs and 16 digital outputs are available.

Like any PC hardware, the CPCI-510 needs software to command and control it. Data acquisition, data display and data storage applications are available for Windows® 95/98, Windows® NT, and National Instrument’s LabVIEW®. Simply install the software on your CompactPCI system and you will be acquiring and storing data within minutes. When data acquisition is complete, any third party data processing application can be used to analyze the results. Programmers developing their own code will appreciate the commented source code available for all of DATEL’s software. The software was designed using common integrated development environments such as Visual C/C++.

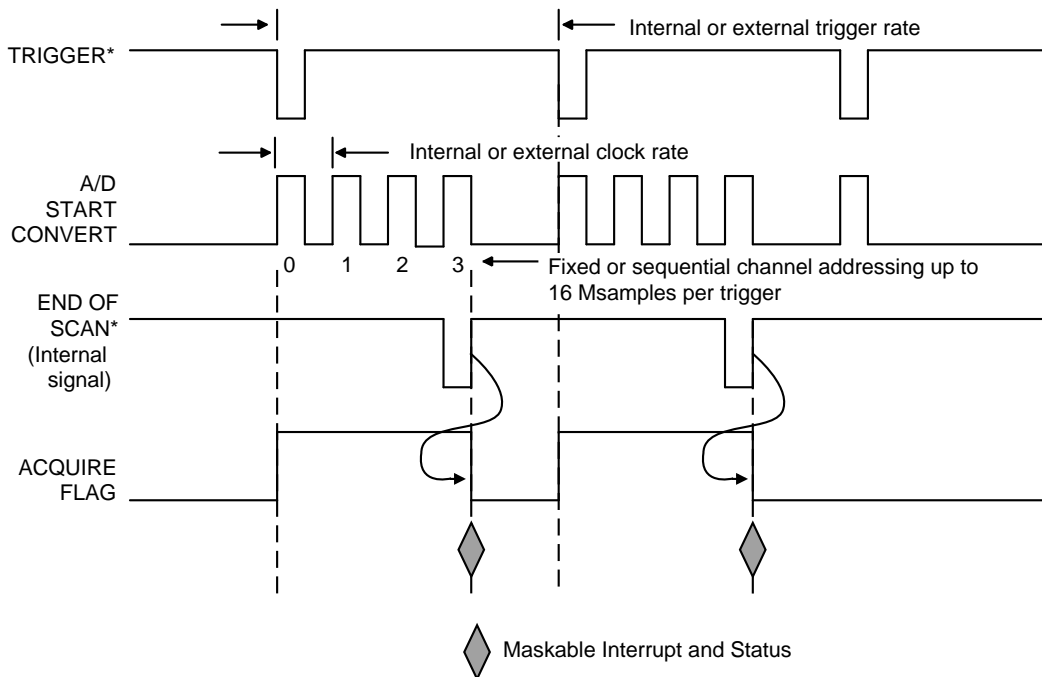


Figure 2. CPCI-510 Timing Diagram

SPECIFICATIONS

(Typical @ +25°C, dynamic conditions, unless noted)

A/D SAMPLE CLOCK	
Sample Clock Sources	Selectable from among: 1. Frequency synthesizer 2. 10 MHz crystal oscillator 3. 20 MHz crystal oscillator 4. 16-stage binary divider
Frequency Synthesizer	to either 1 or 2, maximum input: 10 MHz 5. External digital input Output 5-10 MHz in 625 Hz steps, further divisible by 16-stage binary divider, all software programmable. Up to 40 MHz is available in 2500 Hz steps.
Total Sample Range	76.3 Hz to 40 MHz
TRIGGER CONTROL	
Trigger Sources	1. Analog threshold comparator using internal D/A to set trip level 2. Internal trigger derived from 10 MHz timebase, divided by 32-stage divider (82C54). Range: 20 ns to 429.5 seconds. 3. External digital trigger
Trigger Response	Selectable from among: 1. Starts one frame ("single trigger mode") 2. Collects repeating frames, each started by a trigger ("continuous trigger mode"). 3. Runs the A/D "forever" (sample counter disabled)
A/D Samples per Frame	1 to 16,777,216 samples (24-bit counter) or "forever"
Analog Trigger Input Range	±10V
Marker Input	Digital input which sets A/D bit 15 to logic "1" for one A/D clock cycle. Used to tag samples to external events if enabled.
Pretrigger Mode	The sample down-counter is delayed until an external trigger. Pretrigger samples are stored in a host ring buffer for transient capture, if enabled.
ANALOG OUTPUT	
Number of Channels	One channel
Function	Selectable from among: 1. General-purpose analog output 2. Threshold comparator for A/D trigger
Resolution	16 bits
Output Voltage Range	±10V at 5 mA

Linearity	±4 LSB
Settling Time	6 microseconds (20V step)
Input Coding	Binary 2's complement
PCI Bus	
Data Bus Size	32 bits
PCI Controller Type	AMCC S5933 DMA bus master or slave mode
Data Transfer	32-bit I/O
Bus Transfer Mode	Up to 2 ²⁴ longwords, per PCI spec.
Interrupt	One interrupt, selectable to INTA, B, C, or D
Interrupt Sources	FIFO half full, sample count reached (ACQUIRE flag), bus master transfer done.
MISCELLANEOUS	
Analog Section Modularity	The MUX-S/H-A/D module is socketed for function interchange.
Analog Section Adjustments	Offset and gain per channel. CPCI-510J/L require no adjustments. Recommended recalibration interval is 90 days in stable conditions.
Operating Temp. Range	0 to +60°C, no thermal shock ±5°C max per minute.
Storage Temp. Range	-25 to +85°C
Humidity	10% to 90%, non-condensing
Altitude	0 to 10,000 feet, forced cooling is required
Power Required	+5V dc @ 3A max. and ±12V dc @ 300 mA max. from CompactPCI backplane.
Outline Dimensions	100 x 160 x 20.32 mm, 4 PH compatible to CompactPCI 3U standard
Memory Architecture	First-In, First-Out (FIFO)
LED Lamp	8192 A/D samples Internal light-emitting diode lamp programmable by user for diagnostics, etc.
Digital I/O Port	16 in, 16 out lines, TTL/LS levels, 16 mA output per bit.
CONNECTORS	
CompactPCI bus	110 pin connector (CompactPCI 32 bit)
Front Connector	100-pin connector on front panel. Analog inputs, external digital trigger, external digital clock, digital I/O.

All multiple A/D models may also be software selected as single channel only. Some models may also be short-cycle channel addressed for less than maximum channel capacity.

*No 3.3V power is used.

FUNCTIONAL SPECIFICATIONS

(Typical at +25°C, dynamic conditions, gain = 1, unless noted)

ANALOG INPUTS	CPCI-510E	CPCI-510G	CPCI-510H	CPCI-510J
Number of Channels	16 SE/8 Diff.	2 Simultaneous	One	8 Simultaneous
Input Configuration (non-isolated)	Single Ended or Differential	Single Ended	SE or limited Diff.	Single Ended
Full Scale Input Ranges	±5V, ±10V, 0 to +10V (optional gain = x1 to x1K) CMV = ±10V	±5V (510G2A) or 0 to +10V (510G2B)	±5V (special ranges optional) CMV = ±1V	±5V, ±10V (user selectable) [1]
Input Overvoltage (no damage, power on)	±12V	±12V	±12V	±12V
Overvoltage Recovery Time, maximum	—	2µs	1µs	—
Input Impedance	100 MΩ	>1 MΩ	2 KΩ	8 KΩ
SAMPLE/HOLD				
Acquisition Time	750 ns	350 ns	35 ns	400 ns
Aperture Delay	20 ns	20 ns	±10 ns	—
Aperture Delay Uncertainty	±40 ps	±70 ps	3 ps RMS	—
A/D CONVERTER				
Resolution	12 bits	14 bits	12 bits	12 bits
Conversion Period	500 ns	1 µsec	100 ns	2 µs (all chans. in simul. sampling)
Number of A/D Converters	1	2	1	8
SYSTEM DC CHARACTERISTICS				
Integral Non-linearity (LSB of FSR)	±1	±1.5	±1.5	±1
Differential Non-linearity (LSB of FSR)	±0.75	±1	±1	±1
Full Scale Temperature Coefficient (LSB per °C)	±0.1	±0.3	±1	[1]
Zero or Offset Temperature Coefficient (LSB per °C)	±0.1	±0.3	±1	[1]
SYSTEM DYNAMIC PERFORMANCE				
Sample Rate (single channel only)	1 MHz	1 MHz	10 MHz	400 KHz
Sample Rate per Channel (simul. or sequential chans.)	15 KHz/chan.	1 MHz/chan. (2 simul. chans.)	—	250 KHz/chan. (8 simul. chans.)
Total Harmonic Distortion	-72 dB	-80 dB	-65 dB	-75dB

FOOTNOTES

- CPCI-510J and 510L bipolar input is user-selectable ±5V or ±10V (default) per channel. Total gain error over temperature range is ±4 LSB maximum. Total zero/offset error over temperature range is ±4 LSB maximum. Monotonicity: no missing codes over temperature range.
- The CPCI-16M analog module accepts an optional surface mount precision resistor on each channel for limited gain increase. Preliminary specifications are shown. CMR = 90dB at DC, gain = 1. Input bias current = ±20 pA.
- Data output of the CPCI-14P and Q analog module is pipelined with a 4-sample delay after the first sample clock. The design is intended for semi-continuous sampling of wideband signals and is less suitable for low speed data acquisition.
- Preliminary specifications are shown for the CPCI-510P and CPCI-510Q. Contact DATEL for availability.
- Please note that the D/A section is not a streaming design.

FUNCTIONAL SPECIFICATIONS

(Typical at +25°C, dynamic conditions, gain = 1, unless noted)

ANALOG INPUTS	CPCI-510L	CPCI-510M	CPCI-510P
Number of Channels	16 Simultaneous	4 Simultaneous	4 Simultaneous
Input Configuration (non-isolated)	Single Ended	Differential	Single Ended
Full Scale Input Ranges	±5V, ±10V (user selectable) [1]	±10V [2] (optional gain per channel) CMV = ±10V	±2.5V or 0 to +5V (user selectable)
Input Overvoltage (no damage, power on)	±12V	±12V	±7V
Overvoltage Recovery Time , maximum	—	—	—
Input Impedance	8 KΩ	10 ¹² Ω	1000Ω
SAMPLE/HOLD			
Acquisition Time	400 ns	2 μs	80 ns
Aperture Delay	—	—	—
Aperture Delay Uncertainty	—	—	—
A/D CONVERTER			
Resolution	12 bits	16 bits	14 bits
Conversion Period	2 μs (all chans. in simul. sampling)	5 μs	330 ns
Number of A/D Converters	16	4	4
SYSTEM DC CHARACTERISTICS			
Integral Non-linearity (LSB of FSR)	±2	±4	±3
Differential Non-linearity (LSB of FSR)	±1	±3	±1.5
Full Scale Temperature Coefficient (LSB per °C)	[1]	±1	±0.5
Zero or Offset Temperature Coefficient (LSB per °C)	[1]	±1	±0.5
SYSTEM DYNAMIC PERFORMANCE			
Sample Rate (single channel only)	400 KHz	200 KHz	3 MHz [3]
Sample Rate per Channel (simul. or sequential chans.)	190 KHz/chan. (16 simul. chans.)	200 KHz/chan. (4 simul. chans.)	2.5 MHz/chan. (4 simul. chans.)
Total Harmonic Distortion	-75 dB	-80 dB	-75 dB

Marker Input

When selected in the Command Register, the marker input tags A/D samples to an external event such as a clock timebase. The marker sets bit 15 of the A/D word to logic "1" for one sample clock cycle. Lower A/D bits still retain sign extension polarity. This tag is now stored in the FIFO along with the A/D sample. The user may do this as often as needed, and the marker can be asynchronous with the A/D sample clock. Post processing software then searches through the saved data to find each marked sample. The marker bit is not available for 16-bit A/D's.

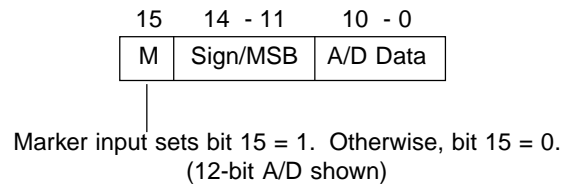


Figure 3. Marker Sample Tagging

ORDERING INFORMATION

Hardware:

CPCI-510E	16SE/8D chanel, 12 bits, Unipolar/bipolar inputs
CPCI-510G2A	2SE simultaneous chanel, 14 bits, Bipolar inputs
CPCI-510G2B	2SE simultaneous channels, 14 bits, Unipolar inputs
CPCI-510H	1SE channel, 12 bits, Bipolar input
CPCI-510J	8SE simultaneous channels, 12 bits, Unipolar inputs
CPCI-510L	16SE simultaneous channels, 12 bits, Unipolar inputs
CPCI-510M	4D simultaneous channels, 16 bits, Bipolar inputs
CPCI-510P	4SE simultaneous channels, 14 bits, Unipolar/bipolar inputs
PC-8506-2	100 conductor 2 foot cable
PC-8404	100 screw terminal adapter board

Software:

CPCI-510WIN	Installation, setup, configuration, and data collection program for Windows 95/98 and Windows NT. Includes a user control panel (GUI), allows board calibration, and saves A/D data to memory and/or disk. Includes LabVIEW VI's. Binary executables only. CPCI-510WIN is included with the board.
CPCI-510WINS	Source code to CPCI-510WIN. Includes Visual BASIC code. CPCI-510WIN consists of the GUI, a library of DLL's and the device drivers. Note: Full software support requires CPCI-510WINS purchase. CPCI-510WINS also includes all CPCI-510WIN binary executables.

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LabVIEW is a trademark of National Instruments
Windows is a trademark of Microsoft Corporation